

SWITCHING  
N-CHANNEL POWER MOS FET

## DESCRIPTION

The 2SK3715 is N-channel MOS Field Effect Transistor designed for high current switching applications.

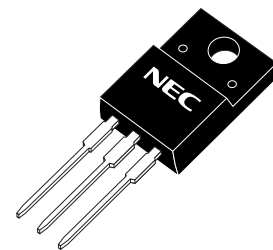
## ORDERING INFORMATION

| PART NUMBER | PACKAGE         |
|-------------|-----------------|
| 2SK3715     | Isolated TO-220 |

## FEATURES

- Super low on-state resistance  
 $R_{DS(on)1} = 6.0 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 38 \text{ A)}$   
 $R_{DS(on)2} = 9.5 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4 \text{ V, } I_D = 38 \text{ A)}$
- Low  $C_{iss}$ :  $C_{iss} = 8400 \text{ pF TYP.}$
- Built-in gate protection diode

(Isolated TO-220)

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

|  |                |             |                  |
|--|----------------|-------------|------------------|
| Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )   | $V_{DSS}$      | 60          | V                |
| Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )    | $V_{GSS}$      | $\pm 20$    | V                |
| Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )      | $I_{D(DC)}$    | $\pm 75$    | A                |
| Drain Current (pulse) <sup>Note1</sup>               | $I_{D(pulse)}$ | $\pm 300$   | A                |
| Total Power Dissipation ( $T_C = 25^\circ\text{C}$ ) | $P_{T1}$       | 40          | W                |
| Total Power Dissipation ( $T_A = 25^\circ\text{C}$ ) | $P_{T2}$       | 2.0         | W                |
| Channel Temperature                                  | $T_{ch}$       | 150         | $^\circ\text{C}$ |
| Storage Temperature                                  | $T_{stg}$      | -55 to +150 | $^\circ\text{C}$ |
| Single Avalanche Current <sup>Note2</sup>            | $I_{AS}$       | 67          | A                |
| Single Avalanche Energy <sup>Note2</sup>             | $E_{AS}$       | 450         | mJ               |

**Notes 1.**  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

**2.** Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 30 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$

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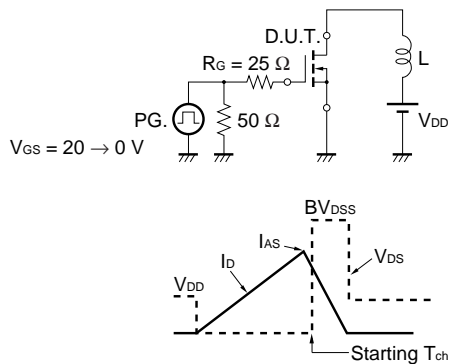
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**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

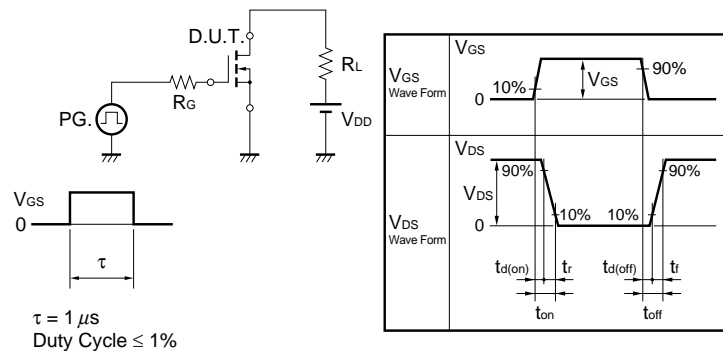
| CHARACTERISTICS                                     | SYMBOL               | TEST CONDITIONS                                | MIN. | TYP. | MAX. | UNIT |
|---|----------------------|--|------|------|------|------|
| Zero Gate Voltage Drain Current                     | I <sub>DSS</sub>     | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V  |      |      | 10   | μA   |
| Gate Leakage Current                                | I <sub>GSS</sub>     | V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V |      |      | ±10  | μA   |
| Gate Cut-off Voltage                                | V <sub>GS(off)</sub> | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA  | 1.5  | 2.0  | 2.5  | V    |
| Forward Transfer Admittance <sup>Note</sup>         | y <sub>fs</sub>      | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 38 A  | 33   | 65   |      | S    |
| Drain to Source On-state Resistance <sup>Note</sup> | R <sub>DS(on)1</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 38 A  |      | 4.8  | 6.0  | mΩ   |
|   | R <sub>DS(on)2</sub> | V <sub>GS</sub> = 4 V, I <sub>D</sub> = 38 A   |      | 6.1  | 9.5  | mΩ   |
| Input Capacitance                                   | C <sub>iss</sub>     | V <sub>DS</sub> = 10 V                         |      | 8400 |      | pF   |
| Output Capacitance                                  | C <sub>oss</sub>     | V <sub>GS</sub> = 0 V                          |      | 1200 |      | pF   |
| Reverse Transfer Capacitance                        | C <sub>rss</sub>     | f = 1 MHz                                      |      | 530  |      | pF   |
| Turn-on Delay Time                                  | t <sub>d(on)</sub>   | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 38 A  |      | 24   |      | ns   |
| Rise Time   | t <sub>r</sub>       | V <sub>GS</sub> = 10 V                         |      | 15   |      | ns   |
| Turn-off Delay Time                                 | t <sub>d(off)</sub>  | R <sub>G</sub> = 0 Ω                           |      | 116  |      | ns   |
| Fall Time   | t <sub>f</sub>       |  |      | 11   |      | ns   |
| Total Gate Charge                                   | Q <sub>G</sub>       | V <sub>DD</sub> = 48 V                         |      | 145  |      | nC   |
| Gate to Source Charge                               | Q <sub>GS</sub>      | V <sub>GS</sub> = 10 V                         |      | 21   |      | nC   |
| Gate to Drain Charge                                | Q <sub>GD</sub>      | I <sub>D</sub> = 75 A                          |      | 39   |      | nC   |
| Body Diode Forward Voltage <sup>Note</sup>          | V <sub>F(S-D)</sub>  | I <sub>F</sub> = 75 A, V <sub>GS</sub> = 0 V   |      | 0.92 | 1.5  | V    |
| Reverse Recovery Time                               | t <sub>rr</sub>      | I <sub>F</sub> = 50 A, V <sub>GS</sub> = 0 V   |      | 59   |      | ns   |
| Reverse Recovery Charge                             | Q <sub>rr</sub>      | di/dt = 50 A/μs                                |      | 136  |      | nC   |

★ **Note Pulsed**

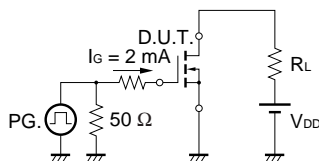
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



**TEST CIRCUIT 2 SWITCHING TIME**

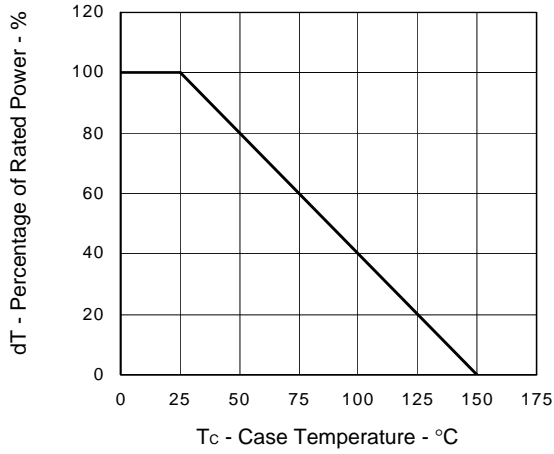


**TEST CIRCUIT 3 GATE CHARGE**

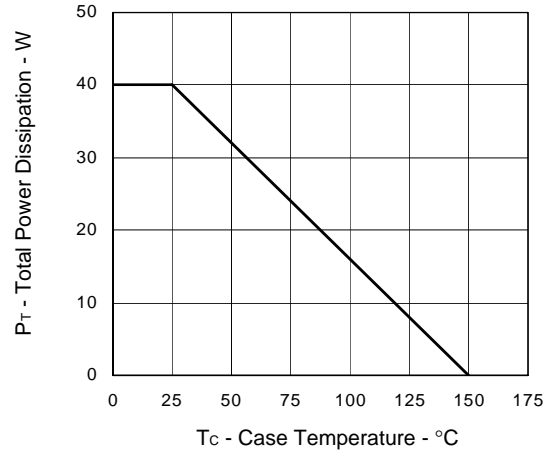


TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA

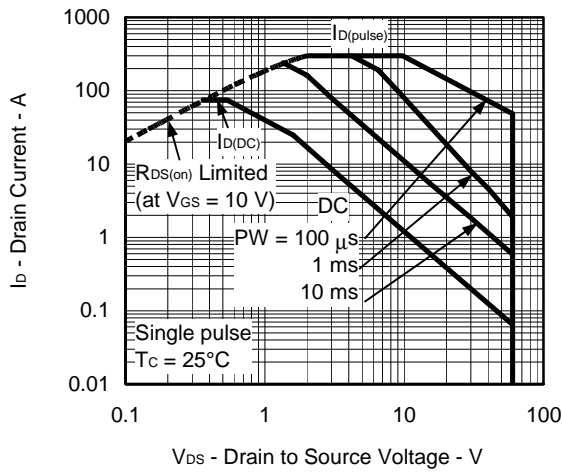


TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

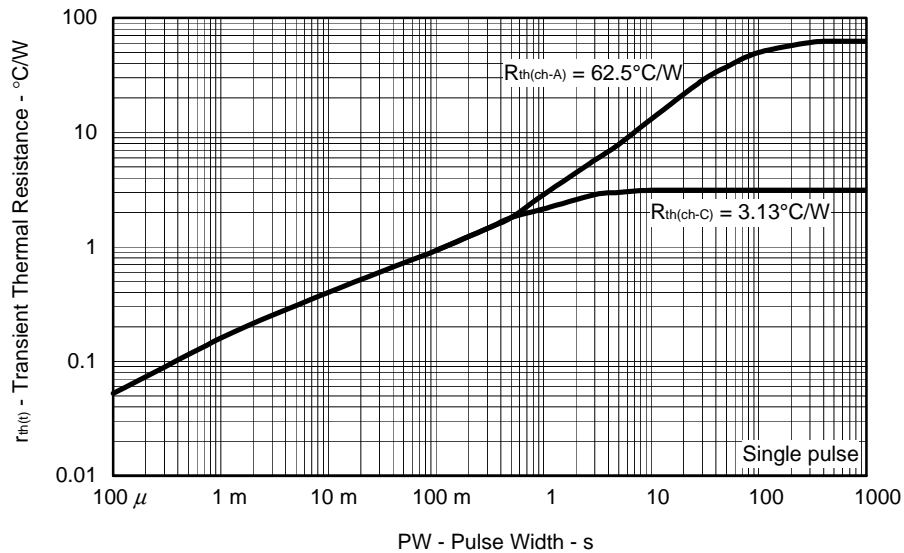


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FORWARD BIAS SAFE OPERATING AREA

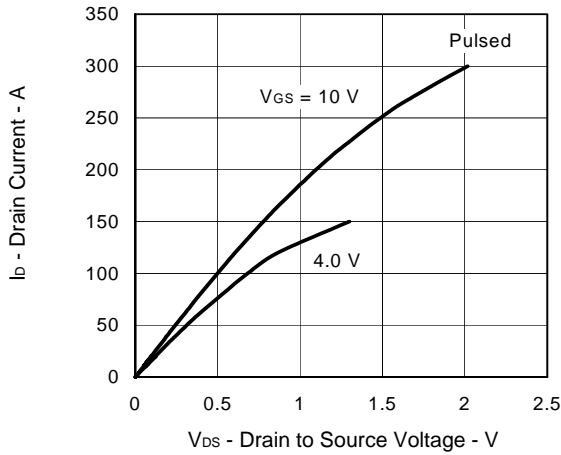


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

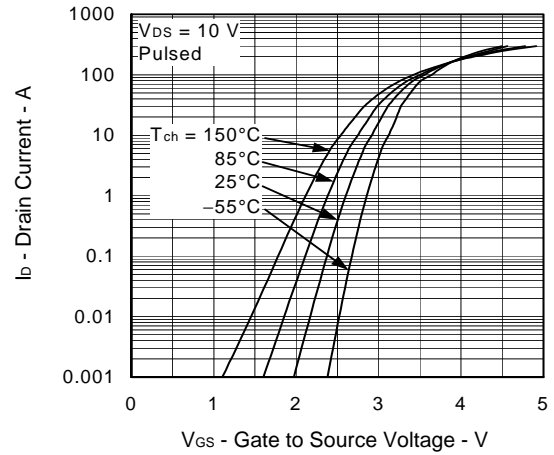


DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

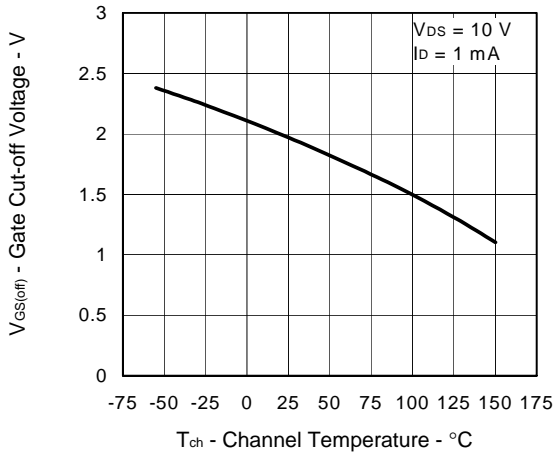
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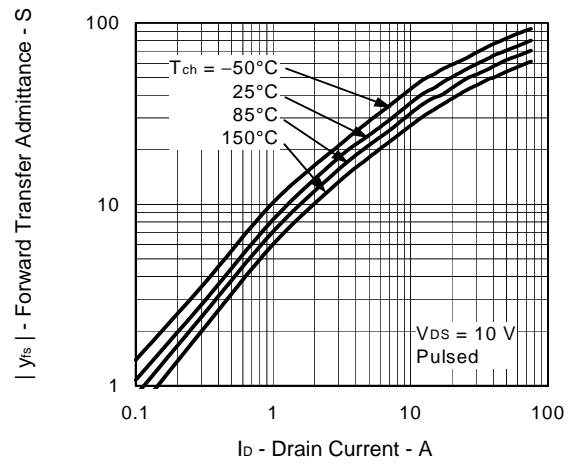
FORWARD TRANSFER CHARACTERISTICS



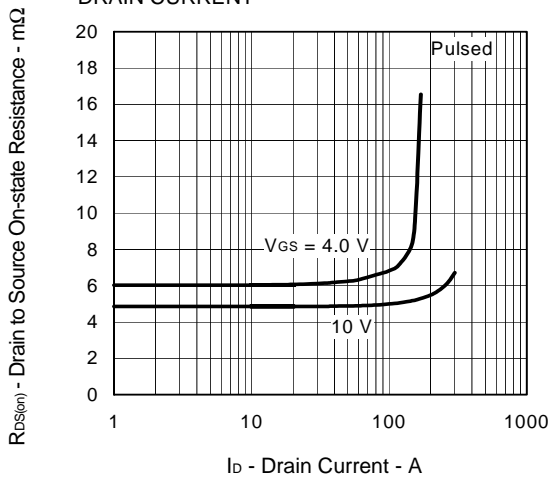
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



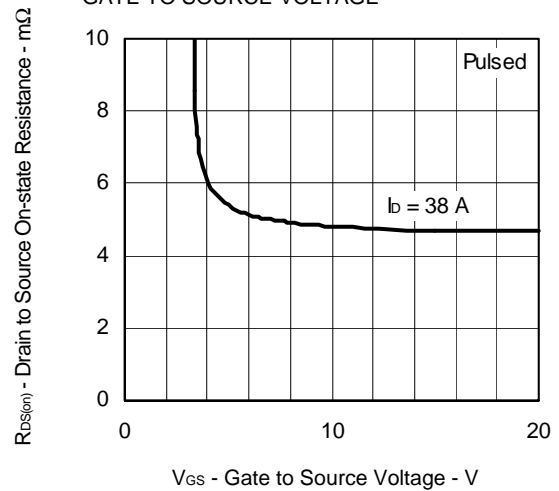
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



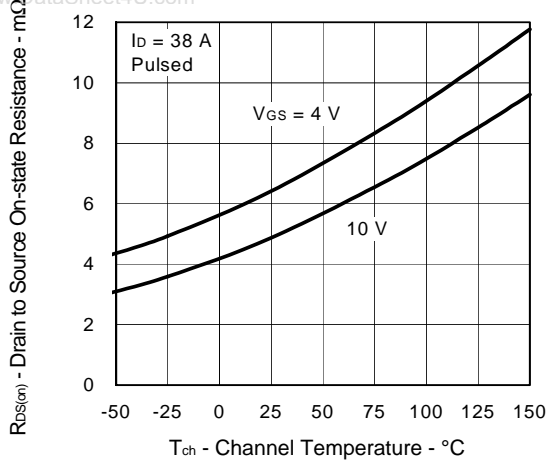
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



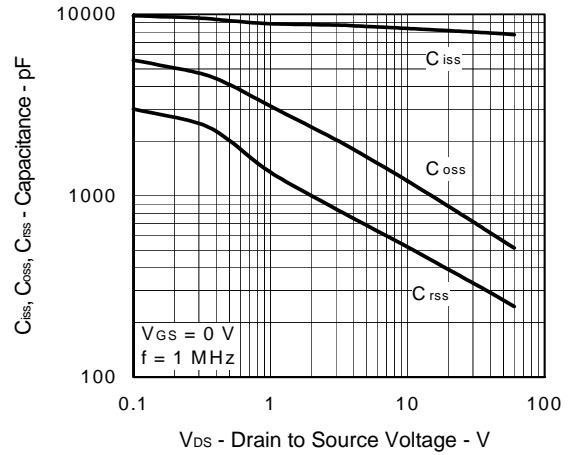
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



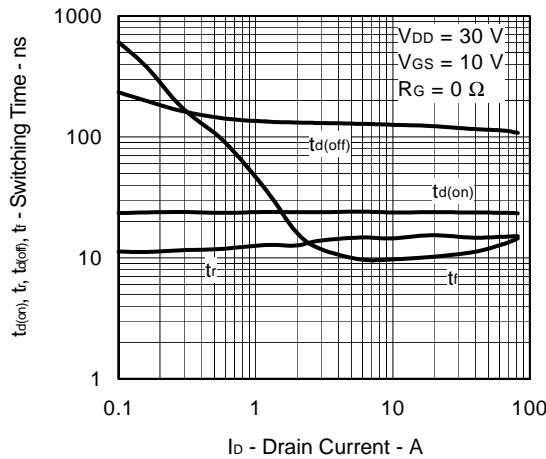
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



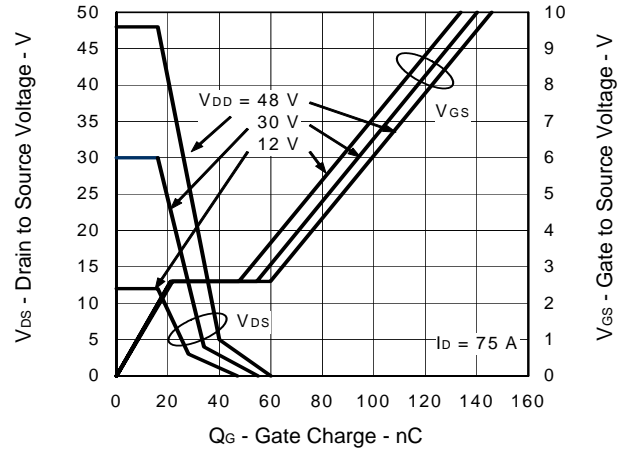
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



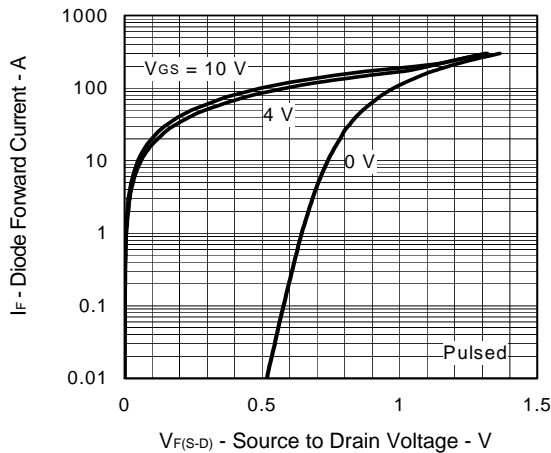
SWITCHING CHARACTERISTICS



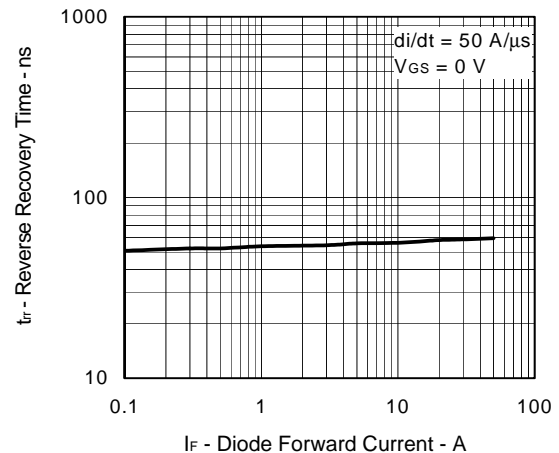
DYNAMIC INPUT/OUTPUT CHARACTERISTICS

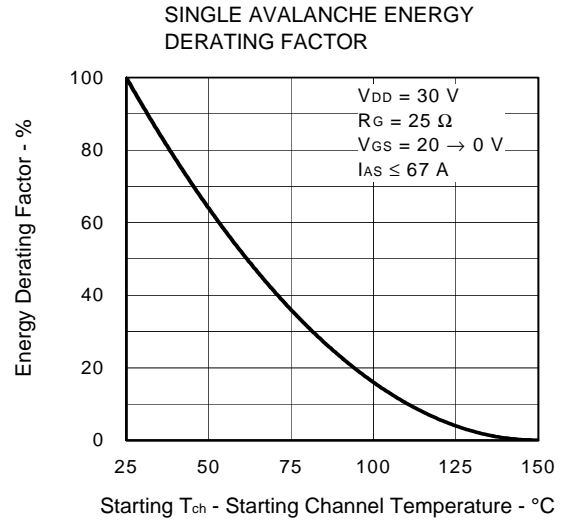
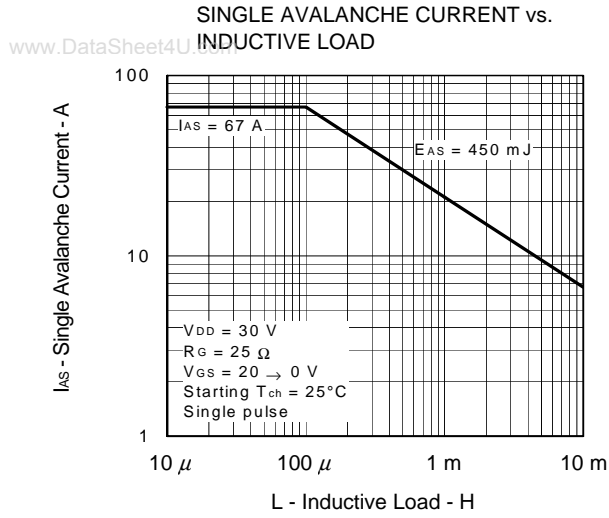


SOURCE TO DRAIN DIODE FORWARD VOLTAGE



REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

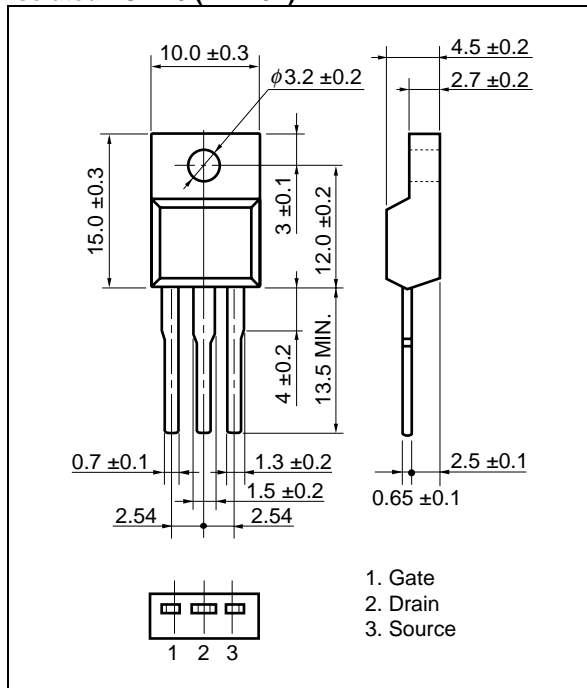




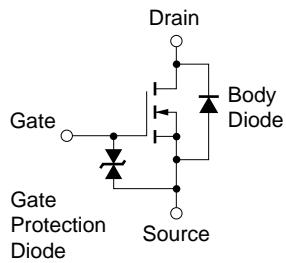
PACKAGE DRAWING (Unit: mm)

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Isolated TO-220 (MP-45F)



EQUIVALENT CIRCUIT



**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD.

When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

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